VOLPE center
The National Transportation Systems Center
Highlights
May/June 2008

The Volpe Center is participating in the deployment of DoD National Airspace upgrades, a global, multiyear effort involving highly skilled teams who provide oversight to major, new-hardware installations that are integral to improving air traffic control and safety both nationally and internationally. The Digital Airport Surveillance Radar, shown here with four F-16 Fighting Falcons, is one of the upgraded systems that the Volpe Center is supporting. (Photo by Ron Fauss)

In this issue:

U.S. Department of Transportation
Research and Innovative Technology Administration
Volpe National Transportation Systems Center

Modernizing the Department of Defense's National Airspace System: An Implementation Challenge

The Volpe Center's Expanding Role

The Volpe Center has proven expertise in developing large-scale, complex systems in many arenas and for many agencies across transportation modes. Until recently, however, the Center regarded itself primarily as a systems research and development institution, concentrating on analyzing transportation requirements and devising solutions that were then implemented by other organizations. The Center's work for the Department of Defense's (DoD) National Airspace System (NAS) modernization, described in this Focus article, exemplifies our ability to deploy complex systems and also demonstrates our capability to provide life-cycle support for large-scale system development and implementation.

Since 1990, the Volpe Center has provided a broad range of support to the U.S. Air Force (USAF) Electronic Systems Center (ESC), 853rd Electronic Systems Group, National Airspace Division (853 ELSG/ND) at Hanscom (continued on page 3)

Letter from the Director

Mr. Robert Suda, Acting Director of the Volpe Center

I became Acting Director of the Volpe Center in January of this year. I am proud of the opportunity to lead an internationally recognized center of innovation during this critical and challenging time for transportation users and practitioners. The transportation enterprise must address growth in the U.S. population as well as changes in population distribution. Congestion, which affects every mode of transportation, causes delays, wasted fuel, and high costs. Transportation energy consumption must be controlled as we move towards the goal of energy independence and sustainability. And the security and safety of the travelling public have always been a DOT priority.

I am continually impressed with the accomplishments of the Center and the dedication and enthusiasm of our employees. As part of the Research and Innovative Technology Administration (RITA), the Center is at the leading edge of research, addressing and resolving a myriad of transportation issues. It is not possible here to mention all the great technological achievements that are going on, but representative projects demonstrate that the Center is involved in many of the significant transformations taking place today.

"We must find 21st-century solutions to 21st-century mobility challenges."

— Department of Transportation Secretary, Mary E. Peters

Transportation Vision for 2030

The Center's contributions to developing intelligent transportation solutions (ITS) meld well with my own background and experience in leading efforts to find information technology solutions across government agencies. ITS refers to the integrated application of a broad range of advanced communication technologies and management strategies to provide traveler information, help relieve congestion, improve safety, and provide precise real-time interaction between vehicles, their operators, and the highways.

The Center's ITS experience includes developing strategies to promote the use of national ITS architecture and ITS standards; incorporating ITS improvements into regional planning methods; and assessing and deploying traveler information systems. More recently, Volpe Center technical experts have been working on several projects that are part of the Vehicle Infrastructure Integration (VII) initiative. This work pertains to deployment of advanced vehicle-vehicle and vehicle-infrastructure communications that could keep vehicles from leaving the road and enhance their safe movement through intersections.

RITA is leading a new initiative, known as SAFE TRIP-21, which aims to expand and accelerate the VII initiative and build on research into the use of sophisticated information, navigation, and communications technologies to further national transportation goals. SAFE TRIP-21 is an integrated, multimodal, multi-application field test of ITS technologies designed to reduce traffic-related fatalities and injuries, fight congestion on America's roadways, and improve the performance of the transportation system. A team from the Volpe Center is supporting this effort, and we will provide more information on this initiative in future issues of *Highlights*. ■

Air Force Base in Bedford, Massachusetts, on the DoD NAS program. This is part of a joint effort with the Federal Aviation Administration (FAA) to modernize current air traffic control (ATC) systems. The program replaces existing analog communications, terminal automation, and radar systems with enhanced digital systems. This group at Hanscom is the lead organization for NAS program upgrades for all Air Force bases worldwide. The Center's role has expanded, from the initial task of assisting in implementation at a single location to a successful partnership in which the Center has significant responsibility for implementing four large systems. The Center is involved in all stages of development and implementation for all subsystems.

Map showing locations of bases where the Volpe Center has implemented DoD NAS system upgrades within the CONUS. OCONUS sites are listed in box.

The scale of this effort is enormous. The Air Force has identified approximately 180 Contiguous United States (CONUS) and Outside Contiguous United States (OCONUS) bases that have received or are designated to receive NAS upgrades over a 15-year period. (Not all bases will receive each upgrade.) This program has been ongoing since 1996 and is projected to extend through 2014. Through its long-term involvement, the Volpe Center has gained the knowledge and experience to provide accurate schedule and budget estimates, and this, as well as the close relationship that we have developed with the ESC, has placed us in a unique position to conceptualize new directions for equipment.

These upgrades are important for both military and civil aviation. Within the CONUS, FAA and DoD share responsibility for the NAS, each having jurisdiction and responsibility for different airspace sectors. Within those sectors, DOD and FAA have the same responsibilities and the same equipment, such that military, civil, and commercial flights pass over DoD- and FAA-controlled airspace seamlessly.

Volpe Center Project Management

Volpe Center project managers demonstrate long-term commitment and accountability. Their expertise ensures that this complex, ever-evolving project operates smoothly, on time, and within budget. Working as a team, the Air Force and the Volpe Center understand that resources and schedules must be readjusted and that both parties must contribute and must comprehend the impacts. The Center has also established good

teaming relationships with the major contractors involved in these upgrades. Scheduling flexibility is required as the master systems deployment schedules are adjusted. At the individual base level, schedule changes and adjustments are anticipated as a result of site survey findings. Schedule adjustments are executed jointly with the Air Force sponsor. The Center ensures contract management excellence and quality control as well as a structured reporting system.

Volpe Center Project Staff

For short biographies and contact information for the current team members, see pages 8 and 9.

The Center has created a cadre of highly skilled engineers who travel to different sites to work on installations. The program responds to changing staffing needs by using a mix of federal and contractor support to absorb increased work requirements.

DoD NAS Systems

The three elements of the DoD NAS program that are currently being installed are:

- **DoD Advanced Automation System (DAAS).** FAA refers to this system as the Standard Terminal Automation Replacement System (STARS), which fuses multiple radar inputs and tracks and displays aircraft and weather to the controller. As an adjunct to DAAS, the Automation Protocol Exchange (APEX) system is being developed by the Air Force to communicate with host nation flight planning systems by translating ATC data between U.S. facilities overseas and foreign national en route control centers.
- **Digital Airport Surveillance Radar (DASR).** This is also known as the ASR-11 digital radar system. The system replaces existing analog radar systems. The Volpe Center supports the 853 ELSG/ND program office in system configuration, enhancements, and system optimization.
- **Airfield Automation System (AFAS).** Within FAA, this system is known as the Aviation Capacity Enhancement–Information Display System (ACE-IDS). This system integrates weather into the displays for air traffic controllers.

Standard Terminal Automation Replacement System (STARS). Workstation displays are configured to provide only the information needed by air traffic controllers. (photo from Raytheon Systems)

DoD Advanced Automation System: STARS

The Standard Terminal Automation Replacement System (STARS) is another component of the NAS modernization effort and provides the capability described in DoD's Advanced Automation System (DAAS) specifications. STARS is designed to support ATC operations at Army, Navy, Air Force, and FAA airport approach facilities and control towers. These systems will replace outdated, difficult-to-maintain terminal automation systems developed in the 1970s and 1980s. DoD must acquire additional systems to support 232 approach facilities and towers.

STARS provides **Terminal Controller Workstations** to controllers in approach control facilities and **Tower Display Workstations** to controllers in airport control towers. Each display can be configured to show only the information needed to support an individual controller's activities. Each STARS installation is tailored to the specific needs and size of

a particular site, from the smallest tower to the largest, most complex combination of towers and approach facilities. Air traffic controllers in airport control towers must manage air traffic on runways and taxiways as well as in more remote areas of the airport. Controllers in approach control facilities manage the remainder of arriving, departing, and low-level overflying air traffic within approximately 50 miles of their airports.

STARS increases the reliability and maintainability of the ATC system and displays additional important information, such as color coding of aircraft experiencing emergency conditions and a better view of the intensity of weather conditions. STARS can easily support future enhancements.

STARS accepts data from airport surveillance radars within a range of about 60 miles as well as from long-range radars. It also accepts data from, and supplies data to, FAA's en-route centers, providing seamless coverage and flight management from the time of takeoff at one airport to the point of landing at another facility. STARS uses only commercial, off-the-shelf hardware and software and a minimum of specialized, newly developed software. The system architecture is based on powerful workstations connected through networks and driving large, high-resolution color displays. Use of commercially available hardware and software will reduce maintenance costs and increase system reliability.

The Volpe Center team is responsible for gathering site-specific data and for performing site preparation as well as integration, checkout, certification, and turnover to the site. The Center also takes a lead role in the transition from the current system to STARS, and each transition is designed to minimize impacts on the normal control of air traffic.

The Volpe Center team is also developing the **Automation Protocol Exchange (APEX),** a system that will enable the U.S. systems to "talk" to host nation systems. More often than not, aviation systems developed by individual nations are incompatible; for example, the U.S. and United Kingdom systems cannot "talk" to each other. This work supports the Air Force program office and includes requirements analysis for host-nation interfaces (HNI) for ATC systems. Center personnel are working on a prototype of a Japanese National Airspace Simulator (JNAS) and an Automated Protocol Converter (APEX) that translates data between U.S. and Japanese ATC systems. This program is evolving and requires frequent exchanges with the customer.

Digital Airport Surveillance Radar: ASR-11

The Volpe Center is supporting the Air Force 853rd Electronic Systems Center at Hanscom Air Force Base and FAA in upgrading existing airport radar surveillance systems for the DoD and civilian airfields. The Digital Airport Surveillance Radar (DASR) is a new terminal ATC radar system that replaces current analog systems with digital technology. DASR detects aircraft position and weather conditions in the vicinity of civilian and military airfields. Older radar systems—some dating back 20 years—are being replaced to improve reliability and performance, provide additional weather data, reduce maintenance costs, and supply new digital automation systems with data for presentation on ATC displays.

Digital Airport Surveillance Radar (DASR). The primary surveillance radar uses a continually rotating antenna mounted on a tower to transmit electromagnetic waves, which deflect (or backscatter) from the surface of aircraft at a distance of up to 60 miles. The radar system measures the time required for a radar echo to return and the direction of the signal. On the basis of these data, the system can then measure the distance and direction of aircraft. The primary radar also provides data on six levels of rainfall intensity. The secondary radar, as shown here, is attached to the top of the primary radar antenna to transmit and receive data on barometric altitudes, identification codes, and emergency conditions for aircraft in the area.

The new system, known as ASR-11, comprises two electronic subsystems: a primary surveillance radar and a secondary surveillance radar, sometimes called the beacon. The total ASR-11 system is complex and includes the following: antenna tower; electronic equipment shelter/building with heating, ventilation, and air conditioning; power distribution system; uninterruptable power supply; backup emergency engine/generator set; fire detection; security; and cabling to connect radar to the local radar approach control center. Telephone and power lines will also be provided to the site. Other equipment used to support ASR-11 may include moving target indicator reflectors and the monopulse secondary surveillance radar remote system monitor.

To ensure uninterrupted ATC monitoring, the existing radar must continue to operate while the replacement radar is sited, constructed, and tested. This task usually requires that a new site for the new radar be identified. Site preparation, electronic equipment installation, checkout, and commissioning of ASR-11 typically take 12 months to complete.

The Volpe Center is taking the lead role in upgrading the **Advanced Signal Data Processor** system for the DoD. This has included upgrades to signal data processing for the new radar system. Existing systems are based on obsolete, early 1990s technology, which are characterized by insufficient memory for enhancements and a lack of scalability. The new ADSP processors will replace multiple computer processors with greater capacity, speed, and functionality. They will be substantially more reliable as well as being expandable, scalable, and capable of supporting future enhancements. It is estimated that, when these enhancements are implemented, ASDP could be the biggest improvement to airport surveillance radar in 25 years. It is also a significant step in moving towards open-system architecture.

Airfield Automation System Consolidated Display (AFAS).

Airfield Automation System (AFAS)

The Volpe Center's role extends beyond deployment to comprise responsibility for the entire new system, including architecture definition, scheduling, installation, testing, and ensuring network connectivity. This reflects our client's growing trust in the Center's capability to take on a larger role.

AFAS, known within FAA as the Aviation Capacity Enhancement-Information Display System (ACE-IDS), is an information display and dissemination system that integrates weather information for air traffic controllers, thus reducing the number of segregated displays and control systems they must monitor.

AFAS-consolidated displays enhance controllers' situational awareness by providing a single focal point for data access. AFAS replaces multiple display and control systems that take up room and are inefficient to maintain. AFAS integration will result in cost savings and streamlined ATC operations for the Air Force.

Completed Tasks

Enhanced Terminal Voice Switching (ETVS)

The Volpe Center has completed the task of replacing old voice communications systems with the new system, Enhanced Terminal Voice Switching (ETVS). ETVS ties the air traffic controller, air crews, and ground personnel into a digital voice communications network. These communication systems have replaced existing analog voice systems that are approaching the end of their life cycle, and provide state-of-the-art, air-to-ground, ground-to-ground, and intercom communications for controllers of military and civil air traffic. The new system consolidates all telephonic and radio communications into a single device with a touch-entry display, an improvement on the multiple handsets and headsets that characterized the earlier, thirty-year-old operational environment.

System Upgrades

The DoD NAS upgrade effort is both complex and long-term. Center staff are using their expertise and experience in the field to recognize new and evolving user requirements and to match these needs with new equipment and technologies as they become available.

Conclusion

As described in this article, through its support for the NAS system upgrade, the Volpe Center has developed expertise in deploying large-scale systems both nationally and internationally. Center staff have faced unexpected challenges, solved problems, adapted to site-specific situations, and established strong relationships with our client and other contractors, across national boundaries. Our clients have also benefited from the life cycle experience of Volpe Center technical personnel, who have experience in system development as well as deployment. This broad understanding enhances our service to our clients. The Volpe Center builds on this experience and welcomes the opportunity to provide implementation expertise in other related areas across the NAS spectrum of communications, navigation, and surveillance. ■

A B-1 long-range strategic bomber takes off in the snow. (photo by Bob Glass)

Volpe Center's DoD NAS Team

The team's strength comes not only from their collective skills and talents but from their long-term experience working together and addressing and solving problems in real time out in the field as well as during the planning stages.

Mike Egan, Program Manager
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Mike Egan manages Volpe Center's work on the DoD NAS program, which involves the long-term replacement of the DoD's terminal air traffic control infrastructure. He also serves as chairman of the ASR-11 terminal radar/Standard Automation Replacement System (STARS) interoperability working group. He was one of the developers of the "System of Systems" optimization process for terminal radar and automation systems. Before joining the Center, he was an air traffic control officer and operational test manager in the U.S. Air Force. He has an MBA in aviation.

Antonino (Tony) G. D'Eramo, Deputy Program Manager
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Tony D'Eramo is a general engineer and deputy program manager for the DoD NAS modernization project. He has served as site preparation resources manager and lead engineer for several deployment activities worldwide. Previously, he managed several U.S. Postal Service environmental and energy projects and FAA condition assessment projects. Additionally, he served as the Chief of the Engineering and Planning Branch, responsible for facilities planning, development, design, and capital maintenance projects at the Volpe Center. After serving in the U.S. Army, he began his federal career as a Federal Highway Administration engineer. He has a Bachelor of Science degree in civil engineering.

Jack Clark
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Jack Clark is an information technology specialist, supporting the DoD NAS modernization program by providing key information system security expertise to the program as well as assisting with the engineering and installation of the Airfield Automation System (AFAS). He has a Bachelor of Science degree in business administration and a Masters in management, with certification as a Certified Information Systems Security Professional (CISSP) and Information Technology Infrastructure Library (ITIL).

Erik Ferland
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Erik Ferland is an electrical engineer supporting the DoD NAS project. He is currently part of the team that is developing interfaces between national airspace systems and STARS as well as developing flight data systems at overseas locations. He has been involved in the design and deployment of fiber-optic communication and cab automation systems at several large airports, such as Denver International, Los Angeles International, and San Francisco International. He has a Bachelor of Science degree in electrical engineering.

Francis G. Ford, PE
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A registered professional engineer, Francis Ford brings his civil engineer skills to support the DoD NAS upgrades for the U.S. Air Force. He also has also worked on FAA and transit security projects and has prepared damage assessments and construction estimates in the Federal Emergency Management Agency's Public Assistance Program. He has Bachelor of Science and Master of Science degrees in civil engineering.

Robert E. Glass
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Bob Glass is an electrical engineer supporting the DoD NAS project. He is currently part of a team deploying the Airfield Automation System (AFAS) to USAF locations worldwide. He also provides engineering support for STARS installations. He has a Bachelor of Science degree in electrical engineering.

Peter R. Kennett, PE
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Peter Kennett is the project manager for the NAS Upgrade Program Digital Airport Surveillance Radar (DASR) Advanced Signal Data Processor (ASDP). A registered professional engineer, he is a subject matter expert in lightning protection, grounding, and critical power delivery, providing consulting advice to the Air Force and other DoD NAS stakeholders. He designed the medium-frequency antenna systems employed in the Volpe Center's Panama Canal Communications, Traffic Management, and Navigation system (CTAN) project. His previous private sector experience related to real-time control systems. He is currently a student pilot and has a Bachelor of Science degree in electrical engineering.

Philip King
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Philip King serves as a lead engineer for the DoD NAS Program. He has coordinated, managed, surveyed, installed, and activated several air traffic control systems for the U.S. Air Force. He supported the Runway Incursion Reduction Program, serving as the program manager, installation engineer, and test manager for the Loop Technology program at Long Beach Airport. He has a Bachelor of Science degree in electrical engineering.

Theofilos Papadopoulos
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Theofilos Papadopoulos is an electrical engineer supporting the NAS modernization program. He recently led and managed the effort to relocate all air traffic control and landing systems at Kunsan Air Base in Korea. He contributed to the design and development of the Differential GPS Radio Beacon shelters in Honduras for the U.S. Agency for International Development (following the devastation caused by Hurricane Mitch) and CTAN transponder units for the Enhanced Vessel Tracking System (EVTS) Project for the Panama Canal Commission (PCC). He has a Masters degree in computer information systems, a Masters Certificate in telecommunications, and a Bachelor of Science degree in electrical engineering.

Kevin O'Neill
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Kevin O'Neill is an information technology specialist. He provides network and information system security support for the FAA and is supporting the NAS modernization program. Kevin has a Bachelor of Science degree in computer engineering and certification as CISSP.

Angelo V. Rallo
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Angelo Rallo is an electronics engineer supporting the NAS program. He has been the lead engineer for the new deployment of Airfield Automation Systems. He has been the lead for survey, site prep, and cutover of STARS systems at Elmendorf AFB, Mountain Home AFB, and Luke AFB. He contributed to the relocation at Kunsan Air Base and recently supported an FAA survey for Surface Decision Support System. He has a Bachelor of Science degree in electrical engineering.

Edward J. Recka
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Edward Recka is a program analyst with extensive experience working with DoD, specifically with the U.S. Air Force. He has led software development projects and logistics studies. Currently, he is supporting the NAS program at the administrative and financial program support level. He has a Bachelor of Science degree in biology and an MBA in finance.

Linda Tang
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Linda Tang is a systems engineer supporting the STARS and Host Nation Interface projects. She develops technical strategies for STARS and is part of the team developing the flight data exchange interface between STARS and foreign country automation systems. She has extensive software and hardware development and deployment experience and has a Bachelor of Science degree in electrical engineering. ■

2008 TRANSPORTATION RESEARCH BOARD ANNUAL MEETING

The 87th annual meeting of the Transportation Research Board took place in Washington, D.C., from January 13–17. The spotlight theme for 2008 was Partnerships for Progress in Transportation. The meeting featured more than 3,000 presentations in nearly 600 sessions. Attendees across all transportation modes included administrators, researchers, and representatives of government, industry, and academic institutions. Volpe Center staff presented at a number of meetings, including poster sessions and panel discussions. In addition, they contributed to the Research and Innovative Technology Administration display, in which the Center is evaluating facial feature recognition software designed to refine warning systems. This work is sponsored by the National Highway Traffic Safety Administration and the Federal Railroad Administration.

Presentations

- Dr. Joyce Ranney and Dr. Michael Zuschlag, both of the Human Factors Division, presented **"Changes in U.S. Railroad Workplace Practices Associated with Combined Behavior-Based and Continuous-Improvement Safety Implementation."**
- Dr. Theodore Sussmann, of the Structures and Dynamics Division, and Dr. James Hyslip, of HyGround Engineering, LLC, presented **"Track Substructure Design Methodology and Data."**
- Mr. Gary Ritter, of the Service and Operations Planning Division, presented **"SafeTrip-21."**
- **"Improved Tank Car Safety Research"** was presented by Dr. David Jeong and Mr. David Tyrell, both of the Structures and Dynamics Division.
- Dr. Douglass Lee, of the Economic and Industry Analysis Division, presented **"Toward the Evaluation of Value Pricing."**
- **"Balancing Community Livability and Freight Movement: Baltimore City and its Port Area"** was presented by Ms. Rachael Barolsky and Dr. David L. Damm-Luhr, both of the Planning and Policy Analysis Division.
- Mr. David Jackson, of the Service and Operations Planning Division, Mr. Sean Peirce, of the Economic and Industry Analysis Division, Mr. Michael Baltes, of the Federal Transit Administration, and Ms. Margaret Zirker, of Cambridge Systematics Inc. (a Volpe Center contractor), coauthored **"Urban Partnership Proposals: Review of Domestic and International Deployments and Transit Impacts from Congestion Pricing."**
- Ms. Gina Barberio and Ms. Rachael Barolsky, both of the Planning and Policy Analysis Division, presented **"Planning and Environment Linkages: Using the PEL Umbrella Approach to Streamline Transportation Decision Making,"** which was coauthored with Mr. Michael Culp and Mr. Robert Ritter, both of the Federal Highway Administration.
- Dr. Ronald Mauri, of the Economic and Industry Analysis Division, Mr. Leopold Wetula, of the Service and Operations Planning Division, and Mr. Dan M. Black, of the National Railroad Passenger Corporation, presented **"Development of New Amtrak Performance Tracking System."**
- Dr. Joshua Templeton, Dr. Don Pickrell, and Dr. Ronald Mauri, all of the Economic and Industry Analysis Division, presented **"Estimation of Amtrak's Avoidable Costs."**

Workshops

- Dr. Joyce Ranney, of the Human Factors Division, and Dr. Michael Coplen, of the Federal Railroad Administration, presided over the workshop on **Increasing Utilization, Impact, and Effectiveness of Research and Development: Stakeholder Involvement Strategies in Evaluation.**
- At the workshop on **Planning Transportation Security and Infrastructure Protection: U.S. and International Perspectives,** Mr. Michael G. Dinning, of the Volpe Center's Director's Office, presented **"Maximizing the Benefits of Situational Awareness in Transportation."**
- Dr. Judith Bürki-Cohen, of the Human Factors Division, and Dr. John D. Lee, of the University of Iowa, presided over the workshop on **Operator Performance Modeling: Case Studies and Emerging Opportunities.**
- Dr. Thomas Sheridan, of the Human Factors Division, was the leadoff speaker at the workshop on **Human Performance Modeling.**

Poster Sessions

- Mr. George Noel, Mr. David Senzig, Mr. Christopher Roof, and Mr. Gregg G. Fleming, all of the Environmental Measuring and Modeling Division, and Dr. Judith Patterson, of Concordia University, presented **Analysis of ICAO Departure Profile Using Real-Time Cockpit Flight Data Recorder Information.**
- Ms. Ann Steffes and Dr. Jeffrey Bryan, both of the Planning and Policy Analysis Division, and Mr. Michael Lee Pack, of the University of Maryland, presented **Overview and Status of Regional Integrated Transportation Information System in the National Capital Region.**
- Mr. Sean Peirce and Ms. Jane E. Lappin, both of the Economic and Industry Analysis Division, Ms. Margaret Zirker, of Cambridge Systematics Inc. (a Volpe Center contractor), Mr. Yehuda Gross, of the Federal Highway Administration, and Mr. Michael R. Baltes, of the Federal Transit Administration, coauthored **Vehicle-Infrastructure Integration: Applications for Public Transit.**
- **Online Deployment of Dynamic Traffic Assignment: Evaluation and Lessons** was coauthored by Dr. Scott Smith, of the Service and Operations Planning Division, Mr. Yang Wen and Dr. Moshe Ben-Akiva, both of Massachusetts Institute of Technology, and Dr. Ramachandran Balakrishna, of the Caliper Corporation.
- Dr. Bruce Wilson, of the Advanced Safety Technology Division, presented **Safety Benefits of a Road Departure Crash Warning System.**

Sessions Chaired

- Ms. Katie Kelly, Volpe Center Chief Counsel, presided over the panel discussion **Disability Issues: Hiring and Working with Disabled Engineers, Attorneys, and Other Transportation Professionals.**
- Dr. Theodore Sussmann, of the Structures and Dynamics Division, presided over the session **Design of Railroad Track Structure for Increasing Axle Loads.**
- Dr. Eugene Gilbo, of the Traffic Flow Management Division, presided over the session **NextGen Research on Aviation Capacity.**
- Dr. Douglass Lee, of the Economic and Industry Analysis Division, presided over the Transportation Economics Committee meeting.
- Ms. Rachael Barolsky, of the Planning and Policy Analysis Division, presided over the **FTA Public Transportation Participation Pilot Program** session.
- Ms. Anya A. Carroll, of the Office of Surface Transportation Programs, presided over the panel discussion on **Intermodal Pedestrian and Trespass Issues.**

The Volpe Center has examined ways in which Vehicle-Infrastructure Integration (VII) technology could be used to support public transit and paratransit services. By engaging transit managers in the discussion, they identified top applications of interest to transit. Center staff presented the results of this work at the International Transit Innovations and Enhancements TRB session. (photo ©iStockphoto.com)

TRB DVD

A DVD of the papers given at this conference—TRB 87th Annual Meeting Compendium of Papers (2008, accession number 01084478)—may be purchased from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, D.C. 20001

- Mr. Robert Dorer, of the Office of Surface Transportation Programs, presided over the **Railroad Coordination in Chicago** session.
- Ms. Anya A. Carroll, of the Office of Surface Transportation Programs, presided over the Executive Session the Highway/Rail Grade Crossings Committee as well as the **Open Meeting on Industry and Academia Perspectives on Highway-Rail Grade Crossing Safety Research.**
- Mr. Robert Dorer, of the Office of Surface Transportation Programs, presided over the Rail Group Executive Board Meeting. ■

PUBLISHED AND PRESENTED

Dr. Joyce Ranney, of the Human Factors Division, and Mr. Christopher Nelson, of the RAND Corporation, delivered a final report to the Federal Railroad Administration, *The Impact of Participatory Safety Rules Revision on Incident Rates, Liability Claims, and Safety Culture in the U.S. Railroad Industry,* July 2007 (DOT-VNTSC-FRA-02-05; DOT/FRA/ORD-07/14). This report documents an evaluation of the impact of the safety rules revision on the safety culture, incident rates, and liability claims in the railroad industry. Safety rules revision identifies key rules that are universally enforceable and eliminates unnecessary and conflicting rules. *http://www.fra.dot.gov/downloads/Research/ord0714.pdf*

Dr. Eugene Gilbo, of the Traffic Flow Management Division, and Dr. Scott Smith, of the Service and Operations Planning Division, presented "A New Regression Model to Improve **Aggregate Air Traffic Demand Predictions**" (AIAA 2007-6450) at the AIAA Guidance, Navigation, and Control Conference, Hilton Head, South Carolina, August 20, 2007. The paper describes a new modeling technique that will help the Federal Aviation Administration to better predict potential air traffic congestion problems.

Volpe Center staff presented a paper at the AIAA Modeling and Simulation Technologies Conference, held at Hilton Head, South Carolina, August 20–23, 2007. The paper, "Training Value of a Fixed-Based Flight Simulator with a Dynamic Seat," described research that is part of a long-term initiative to study the **requirements for effective flight-training simulators for the Federal Aviation Administration.** The paper was coauthored by Dr. Judith Bürki-Cohen and Ms. Andrea Sparko, of the Human Factors Division, and Dr. Tiauw Go, of the Massachusetts Institute of Technology.

Wake Vortex Research Presented at European Conference. Members of the Volpe Center's Advanced Communications, Navigation, and Surveillance Technologies Division presented results of their recent wake vortex research at the 1st Council of the European Aerospace Societies (CEAS) European Air and Space Conference, in Berlin, Germany, September 10–13, 2007. "Comparison Between Arrival and Departure Wake Vortex Statistics Near the Ground" was co-authored by Mr. Stephen M. Mackey, Mr. Hadi Wassaf, Dr. Frank Wang, and Ms. Melanie Soares. The study was sponsored by the Federal Aviation Administration and highlights a finding that vortices generated from departure aircraft are not significantly different from those of the arrival aircraft. The conference featured the current wake turbulence research from the U.S. and Europe. Attendees included members from aerospace societies from France, Germany, Great Britain, Italy, The Netherlands, Spain, Sweden, and Switzerland.

Rail Research Presented at ASME Conference. Several members of the Volpe Center's Structures and Dynamics Division presented papers at the American Society of Mechanical Engineers (ASME) 2007 Rail Transportation Division (RTD) Fall Technical Conference in Chicago, Illinois, September 11–12, 2007. The papers are listed below:

- "Improved Tank Car Safety Research," by Mr. David Tyrell, Dr. David Jeong, Ms. Karina Jacobsen, and Mr. Eloy Martinez (of FRA, formerly of the Volpe Center).

The paper provided an overview of the FRA-sponsored tank car structural integrity research being performed by Volpe Center. (RTDF2007-46013) *http://www.volpe.dot.gov/sdd/docs/2007/asme_rtdf2007-46013.pdf*

- "Equations of Motions for Train Derailment Dynamics," by Dr. David Jeong, Mr. Matt Lyons, Dr. Oscar Orringer, and Dr. A. Benjamin Perlman, describes the use of a two-dimensional model to simulate the motions of rail cars in a generalized train derailment and examines the relative effect of different factors on the derailment outcome. (RTDF2007-46009) *http://www.volpe.dot.gov/sdd/docs/2007/asme_rtdf2007-46009.pdf*
- "Developing Strategies for Maintaining Tank Car Integrity During Train Accidents," by Mr. David Tyrell, Ms. Karina Jacobsen, Mr. Brandon Talamini, and Mr. Michael Carolan. This paper describes a framework for developing strategies to maintain the structural integrity of tank cars during accidents. (RTDF2007-46015) *http://www.volpe.dot.gov/sdd/docs/2007/asme_rtdf2007-46015.pdf*
- "Analysis of Impact Energy to Fracture Unnotched Charpy Specimens Made from Railroad Tank Car Steel," by Dr. Hailing Yu (of CASE, LLC, a Volpe Center contractor), Dr. David Jeong, Mr. Jeffrey Gordon, and Ms. Yim Tang. This paper describes the use of a nonlinear finite element analysis framework to calculate the impact energy needed to fracture unnotched Charpy specimens (made from railroad tank car steel). (RTDF2007-46038) *http://www.volpe.dot.gov/sdd/docs/2007/ asme_rtdf2007-46038.pdf*
- "Analyses of Full-Scale Tank Car Shell Impact Tests," by Ms. Yim Tang, Dr. Hailing Yu (of CASE, LLC, a Volpe Center contractor), Mr. Jeffrey Gordon, Ms. Michelle Priante, Dr. David Jeong, Mr. David Tyrell, and Dr. Benjamin Perlman. This paper compares results from finite element and collision dynamics models to results from the full-scale impact tests. (RTDF2007-46010) *http://www.volpe.dot.gov/sdd/docs/2007/asme_rtdf2007-46010.pdf*

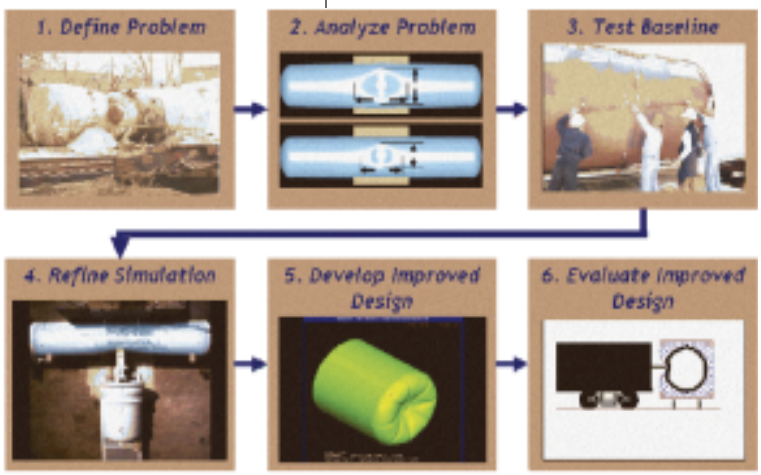

Illustration from paper on Improved Tank Car Safety Research given at ASME conference, showing the research steps to develop improved tank car design.

Dr. Jeong coauthored another presented paper, "Fatigue Crack Growth Behavior of TC-128B Steel Under Variable Amplitude Loading" (with Dr. Daniel Garcia, Dr. Peter McKeighan, Mr. James Feiger, and Mr. Joseph Cardinal, all of the Southwest Research Institute). Since multiple models must be used to predict loading, this study outlines the methodology necessary to generate tank-car-specific life models, used to predict spectrum crack growth data representative of tank-car-usage. Dr. Jeong also chaired a session on Locomotive Performance Issues.

Tank car positioned for full-scale tests; the tank car contains water mixed with clay slurry to produce the density approximately equal to that of liquid chlorine.

Human Factors Continuing Research. Several members of the Human Factors Division presented papers at the Human Factors and Ergonomics Society's 51st Annual Meeting in Baltimore, Maryland, October 1–5, 2007. The Society's mission is to promote the discovery and exchange of knowledge concerning the characteristics of human beings that are applicable to the design of systems and devices of all kinds. Papers by Volpe Center experts are listed below:

- "Pilot Identification of Proposed Electronic Symbols for Displays of Aeronautical Charting Information," by Dr. Divya Chandra, Dr. Michelle Yeh, and Ms. Colleen Donovan (of FAA).
- "Applying a Sociotechnical Framework for Improving Safety at Highway-Railroad Grade Crossings," by Dr. Michelle Yeh and Dr. Jordan Multer.

Also, Dr. Thomas Sheridan was keynote speaker, presenting "Human-Automation Interaction in the Next-Generation Air Transportation System."

Volpe Center staff members presented papers at the 26th **Digital Avionics Systems Conference,** which took place in Dallas, Texas, October 21–25, 2007. Digital avionics is that part of avionics concerned with digital, usually computerized, technology. Digital avionics is used by modern aircraft in a

wide range of applications. Papers from this conference are available in *Proceedings of the IEEE/AIAA 26th Digital Avionics Systems Conference,* October 21–25, CD-ROM, 2007.

- "Categories for Classification of Aircraft Flight Model Validation," by Dr. Seamus McGovern, of the Terminal and Surface Systems Division, offers a methodology for comparing different methods of validating pre-existing aircraft flight models. This was awarded "Best Paper of Session."
- "Kinematics-Based Model for Stochastic Simulation of Aircraft Operating in the National Airspace System," by Dr. Seamus McGovern and Mr. Minh Truong, both of the Terminal and Surface Systems Division, Mr. Seth B. Cohen (of Boeing Aircraft), and Mr. Gerard Fairley (of CSC, a Volpe Center contractor). This paper presents the general mathematical aircraft formulation for a kinematics-based model, a description of both the pilot and aircraft models and parameters, and an explanation of the concept for and design of a future control system.
- "Improving ETMS' Ground Time Predictions," by Mr. Aron Futer (of CSC, a Volpe Center contractor). The paper demonstrates that the Ground Time Predictions model reduces errors in estimating flights' departure times and makes the error distributions narrower and also proposes an algorithm that reduces departure time error in case of large departure delays.

Reducing Traffic Noise. Ms. Judith Rochat, of the Volpe Center's Environmental Measurement and Modeling Division, participated in the Noise-Con Conference in Reno, Nevada, October 20–26. She chaired two sessions, "Tire/Pavement Interaction Noise-General" and "Tire/Pavement Interaction Noise-On Board Sound Intensity," (OBSI) and presented the paper "Investigating the Implementation of Pavement Effects via OBSI Data in the FHWA Traffic Noise Model (FHWA TNM)." The Volpe Center supports the Federal Highway Administration and other federal, state, and local agencies in the development of strategies to reduce tire-pavement interaction noise.

Noise measurement equipment used for "quiet pavements" research.

Several Volpe Center staff members attended the **2007 National Highway-Rail Grade Crossing Safety Training Conference** from November 4–7, 2007, in San Antonio, Texas. Ms. Anya A. Carroll, Acting Deputy Director of the Office of Safety Transportation Programs, was on the organizing committee for the conference and moderated sessions on Risk Analysis Methodologies and Pedestrian Crossings. Ms. Suzanne Horton, of the Rail and Transit Systems Division, presented on the Public Education and Enforcement Research Study during the session on Railroad and State Education Initiatives. Mr. Marco DaSilva, of the Advanced Safety Technology Division, presented on the Trespasser Demonstration Project during the session on Trespass and Suicide Issues. Dr. Jordan Multer, of the Human Factors Division, presented on the Close Calls Project during the Camera and Enforcement Issues session. Mr. Michael Rossetti, of the Advanced Surveillance and Communications Division, presented on weather-related impacts during a session on Risk Analysis Methodologies. The conference brings together researchers from government, industry, and academia from around the world to review, assess, and discuss issues relating to railroad safety.

Transportation Asset Management and Economic Analysis. From November 6–8, 2007, the Transportation Research Board (TRB) national specialty conference, "New Directions in Asset Management and Economic Analysis," was held in New Orleans, Louisiana. The TRB Transportation Economics Committee, chaired by Dr. Douglass Lee, of the Volpe Center's Economic and Industry Analysis

Division, was cosponsor of the conference along with the Asset Management Committee. The conference appears to have been a significant success in combining economic analysis and asset management at a practical level. The approach of Dr. Lee's committee was to present basic economic concepts and methods in an accessible form, provide complementary state and federal perspectives, demonstrate applications by using illustrative examples, and include stimulating current topics such as long-term toll-road leasing. The strategy of sticking to a coherent presentation of basic concepts and applications appears to have been appreciated.

Flight Symbology. In November 2007, Drs. Divya Chandra and Michelle Yeh, both of the Human Factors Division, delivered a final technical report to the FAA, in Washington, D.C., *Pilot Identification of Symbols and an Exploration of Symbol Design Issues for Electronic Displays of Aeronautical Charting Information,* (DOT-VNTSC-FAA-07-07). The report documents the results of a study that will aid in the development of industry recommendations for symbology on electronic displays of charting information.

Plastics and Composites Intensive Vehicles (PCIV) study. Recently, NHTSA and Volpe Center published a final report entitled *A Safety Roadmap for Future Plastics and Composites Intensive Vehicles.* (DOT-VNTSC-NHTSA-07-02; DOT HS 810 863). NHTSA tasked the Volpe Center to assess the current state of knowledge and identify key safety research needs for the development and commercial deployment of PCIVs by 2020. Future lightweight, plastics-rich, and fuel-efficient vehicles must be designed to comply with, meet, or exceed applicable NHTSA crash-safety standards. This study is especially timely in view of national priorities for increasing CAFE standards, to help achieve energy independence and environmental sustainability goals. The study also outlines follow-on research and milestones to measure progress towards PCIV design, development, and technology integration. The report is authored by Dr. Aviva Brecher, of the Planning and Policy Analysis Division, with assistance from Dr. John Brewer and Mr. Samuel Toma, both of the Advanced Safety Technology Division. The complete report is posted on the NHTSA crashworthiness research website: *http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/NRD/Multimedia/Crashworthiness/4680PCIV_SafetyRoadmap-Nov2007.pdf* and also can be downloaded from the Volpe Center website at: *http://www.volpe.dot.gov/library/pp07.html*

Wake Vortex Sound Emissions. A paper written by Dr. Frank Wang and Mr. Hadi Wassaf, both of the Advanced Surveillance and Communications Division, with Dr. Z. C. Zheng and Dr. Wenhua Li, both of Kansas State University, "Influence of Vortex Core on Wake Vortex Sound Emission," was published in *Journal of Aircraft,* v. 44, n. 4, July-August 2007, pp. 1369-1377. The paper had also been presented (as Paper #2538) at the 12th AIAA/CEAS Aeroacoustics Conference, in Cambridge, Massachusetts, held from May 8–10 2006.

Driver Behavior at Red Lights. A paper written by Dr. Wassim Najm, of the Advanced Safety Technology Division, and Dr. C.Y. David Yang, formerly of the Volpe Center, "Examining Driver Behavior Using Data Gathered from Red Light Photo Enforcement Cameras," was published in *Journal of Safety Research,* v. 38, n. 3, 2007, pp. 311-322. The paper examines the contributing factors and circumstances surrounding red light violations, as a necessary precursor to developing an effective driver assistance system that can help prevent these violations.

Road Departure Technology. Dr. Bruce Wilson, Dr. Mary Stearns, and Mr. Jonathan Koopmann, of the Advanced Safety Technology Division, and Dr. C. Y. David Yang of Noblis, Inc. delivered a final report to the National Highway Transportation Safety Administration's (NHTSA), *Road Departure Crash Warning System Independent Evaluation,* December 2007 (DOT HS 810 854). This report documents the Volpe Center's evaluation of a novel collision avoidance system named the Road Departure Crash Warning System (RDCW). The RDCW warns drivers when they are in danger of departing the road, hitting an object in the adjacent lane, or approaching a curve at an unsafe speed. The field operating test (FOT) involved 78 drivers who used the RDCW on public roads for approximately one month. ■

Volpe Center Highlights

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the VOLPE center

Federal 100 Award

Mr. Henry Wychorski attending the Federal 100 Awards Gala.

Henry Wychorski, a senior electrical engineer at the Volpe Center, has been selected to receive a prestigious Federal 100 Award. The award was given to him for developing and demonstrating the Maritime Security and Safety Information System (MSSIS), which tracks the movement of international maritime traffic in real time in the territorial waters of more than 30 countries. This year's awardees were selected because they are "agents of change," and Henry Wychorski's leadership and innovative contribution to maritime traffic monitoring has made a significant difference to both maritime security and traffic management. He received the award at the 19th annual Federal 100 Awards Gala in Washington, D.C., on March 24, 2008.

The Federal 100 Awards recognize individuals from government, industry, and academia who significantly influenced how the federal government buys, uses, or manages information technology. Awardees are selected because they are the people who drive change, who help make government smarter and more efficient. Federal 100 candidates are nominated by readers of *Federal Computer Week*, and an independent panel of judges selects winning entries from government and industry.

Henry has 15 years experience in navigation and communications systems for maritime transportation applications. The technology is based on using Global Positioning Systems data to develop advanced navigation and tracking systems. He is project manager and senior technical lead for the MSSIS.

MSSIS provides Maritime Domain Awareness (MDA) information through an unclassified, multinational, freely shared network. MSSIS uses Automatic Identification System (AIS) data that is broadcast from commercial vessels for tracking the movement of commercial ships in the territorial waters of the member countries.

The Volpe Center, working with the Commander of the U.S. Navy Europe, developed a low-cost network that is capable of collecting and sharing real-time AIS data with multiple users through an Internet-based, password-protected system. The network provides clients with real-time MDA.

Henry worked very closely with senior naval officers and science advisors in the U.S. Navy, U.S. Coast Guard, and NATO countries to make this system operational in 2007. Developing a global system of any kind is time consuming and expensive. He was able to use existing technology, combined with a strong willingness of foreign countries to participate, to build a low-cost, easily deployable, expandable system that provides unprecedented information on international commercial vessel movements. He traveled internationally to meet with customers and recently went to South America to expand the system in the southern hemisphere. ■